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United States Department of Agriculture,

DIVISION OF ENTOMOLOGY.

HOW TO DISTINGUISH THE DIFFERENT MOSQUITOES OF NORTH AMERICA.

In Circular No. 13, of this series, the writer discussed briefly the habits of one of our commonest mosquitoes (*Culex pungens*) and some what at length the remedies to be used against all mosquitoes. This account was abbreviated from the more detailed treatment of the subject in Bulletin No. 4, new series, of this Division.

Since the publication of this circular and of this bulletin widespread interest has been attracted to the subject of mosquitoes and their habits and also to the specific and generic distinctions which exist between different forms. This interest has arisen from the discovery that certain mosquitoes are intermediary hosts in the development of the micro-organisms of malaria. The connection between mosquitoes and malaria, although originally suggested in recent times by an American physician, A. F. A. King, was first demonstrated by experimental work carried on by the English surgeon, Ross, the Italians, Bignami, Grassi, and Bastianelli, and the German, Koch, while the American, McCallum, has followed out the life history of a malarial parasite of the common crow.

The latest work of the foreign investigators shows that not only in South Europe but also in India and in West Africa only mosquitoes of the genus *Anopheles* are concerned in the transmission of the human malarial parasite, although mosquitoes of the genus *Culex* are connected with the transmission of the malarial diseases of birds and possibly of other animals. These conclusions have been confirmed by the Americans, W. S. Thayer, F. N. Berkeley, and Albert Woldert, for America, so far as their work has gone. The latest announced results of the most advanced investigators seem to show that mosquitoes form the principal if not the sole means of transmission of malaria, and workers in all parts of the world, including many parts of the United States, are investigating the subject, more especially in relation to local conditions.

In the course of this work there has arisen considerable difficulty in the identification of local species of mosquitoes. The literature of

this group of insects is fragmentary and scattered. The list published

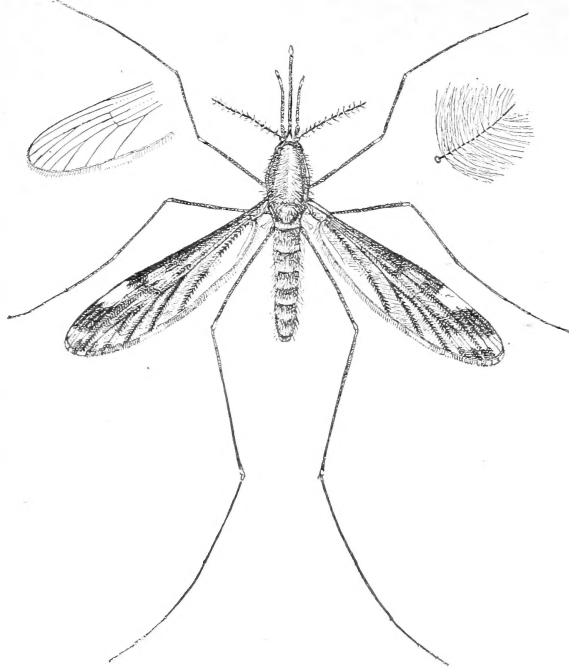


FIG. 1.—*Anopheles punctipennis*, female, with male antennæ at right and wing tip showing venation at left—enlarged (original).

in Bulletin No. 4, new series, of this office, above referred to (1896), is the most complete one which has been published for this country, and it includes a citation of very many actual localities of capture of the different species which give us the first insight into the geographic distribution of the different forms. Very many investigators, mostly physicians, are calling upon this office for assistance in the determination of mosquitoes, or at least

for some indication of the characters by which the different forms may be recognized.

In answer to this demand the following tables have been drawn up at the writer's request by Mr. D. W. Coquillett. They include all of the mosquitoes which have been recorded from North America, and comprise, (I) a synopsis of the five genera into which the long-beaked, blood-sucking mosquitoes known to occur in North America are divided; (II) a synoptic consideration of the species of the genus *Anopheles*, divided into (a) the recognized forms, specimens of which

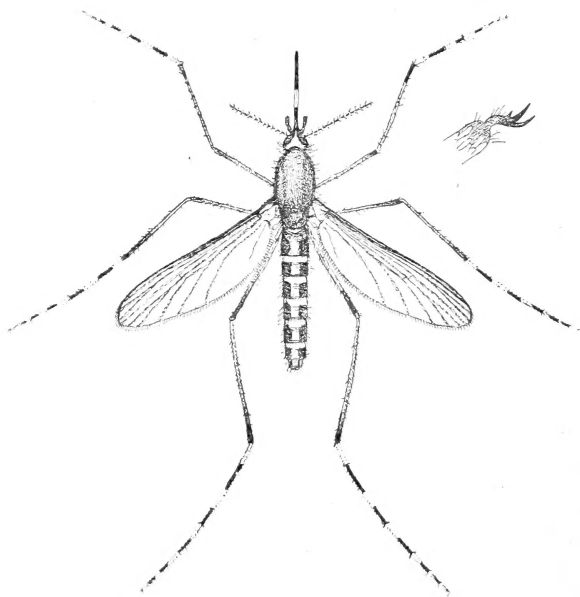


FIG. 2.—*Culex tentorhynchus*, female, showing the short palpi which distinguish *Culex* from *Anopheles*: toothed front tarsal claw at right—enlarged (original).

(a) the recognized forms, specimens of which

occur in the National Museum collection, and (b) the unrecognized forms, which are known only from the literature; (III) a synoptic consideration of the species of the genus *Culex*, divided into (a) a table of the recognized species, and (b) an account of the unrecognized species; (IV) a brief description of the only valid known species of the genus *Psorophora*; (V) a synoptic table of the three known species of the genus *Megarhinus*; and (VI) a synoptic consideration of the two known species of the genus *Aedes*.

So far in the medical literature only the genera *Anopheles* and *Culex* have received consideration, but since this circular is intended simply to aid in the identification of the different forms, the other three genera have been added in order to avoid confusion.



FIG. 3.—Resting positions of *Culex* (at left) and *Anopheles* (at right), enlarged (redrawn from a rough sketch published in the *British Medical Journal*).

The figures which are given illustrate the structural points brought out in the synoptic tables and have been drawn by Miss Sullivan, of this office, under Mr. Coquillett's supervision. The figure representing the difference in the resting positions of *Anopheles* and *Culex* has been redrawn from a sketch made by a member of Ross's expedition to Sierra Leone. Neither the writer nor Mr. Coquillett is able to verify the suggestion that either of these insects uniformly rests in the positions indicated, although it is quite likely that the attitudes shown are the usual ones.

Respectfully submitted.

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Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., February 20, 1900.

SYNOPTIC TABLES OF THE NORTH AMERICAN MOSQUITOES.

By D. W. COQUILLETT.

I.—GENERIC SYNOPSIS.

The following table contains all the genera of the long-beaked mosquitoes known to occur in North America. The males are readily recognized by the antennæ being densely covered with long hairs; in the females the hairs of the antennæ are short and very sparse.

- | | |
|--|---------------------|
| 1. Palpi in the male at least nearly as long as the proboscis, in the female less than one-half as long..... | 2. |
| Palpi in both sexes at least almost as long as the proboscis..... | <i>Anopheles</i> . |
| Palpi in both sexes less than one-half as long as the proboscis..... | <i>Aedes</i> . |
| 2. Proboscis straight or nearly so, colors of body brown and yellowish..... | 3. |
| Proboscis strongly curving downward toward the tip, colors bluish or greenish..... | <i>Megarhinus</i> . |
| 3. Legs bearing many nearly erect scales..... | <i>Psorophora</i> . |
| Legs destitute of such scales..... | <i>Culex</i> . |

II.—GENUS ANOPHELES.

(a) RECOGNIZED SPECIES.

- | | |
|---|-----------------------------|
| 1. With a yellowish white spot near three-fourths of the length of the front margin of the wing; scales of last vein white, those at each end black.. | <i>punctipennis</i> Say. |
| Without such a spot | 2. |
| 2. Scales of last vein wholly black, palpi wholly black..... | <i>quadrimaculatus</i> Say. |
| Scales of last vein white, marked with three black spots, palpi marked with white at bases of last four joints..... | <i>crucians</i> Wied. |

(b) UNRECOGNIZED SPECIES.

The following species which have been credited to our country have not been recognized with certainty; some of them probably do not belong to the present genus, while a few were evidently founded on badly rubbed specimens in which the distinctive characters were therefore wanting:

annulimanus v. d. Wulp. I strongly suspect that this does not belong to the present genus; the description applies fairly well to the male of *Culex consobrinus* Desv. *ferruginosus* Wied. This author proposes this name for the species previously described by Say under the name of *Culex quinquefasciatus*, but the description which he gives differs so decidedly from the one published by Say as to give the impression that it is founded on a different species. I strongly suspect that the type of *ferruginosus* is a rubbed example of *Anopheles crucians*, which was described from the same locality. Say's description of his *Culex quinquefasciatus* agrees very well with the species which I have identified as *Culex impiger* Walker.

maculipennis Meigen. I strongly suspect that this European form is identical with our *Anopheles quadrimaculatus* Say, but this point can not be settled definitely at present, owing to the lack of any European specimens for comparison with ours.

nigripes Staeger. This European species should be readily recognized by its unspotted wings.

albimanus Wied. Differs from our other species by the snow-white apices of the tarsi.

Anopheles pictus Loew I think should be placed as a synonym of *A. crucians* Wied.

Our recognized species of *Anopheles* and their synonyms may therefore be listed as follows, the synonyms indented:

- crucians* Wied.
- pictus* Loew.
- ? *ferruginosus* Wied.
- punctipennis* Say.
- hiemalis* Fitch.
- quadrinaculatus* Say.
- ? *maculipennis* Meigen.

III.—GENUS *CULEX*.

(a) RECOGNIZED SPECIES.

Males.

1. Front tarsal claws bearing a distinct tooth near the middle of the underside of each 3.
- Front tarsal claws bearing two teeth on the underside of one claw, and one on underside of the other, proboscis destitute of a whitish band near the middle 2.
- Front tarsal claws with one tooth on underside of one of the claws, none on the other, bases of tarsal joints white, proboscis destitute of a whitish band near the middle..... *fasciatus* Fabr.
2. Tarsi distinctly white at bases of the joints..... *excitans* Walk.
- Tarsi not white at bases of the joints..... *consobrinus* Desv.
3. Proboscis destitute of a whitish ring near the middle..... 4.
- Proboscis with such a ring, ends of tarsal joints white..... *tarsalis* Coq.
4. Bases of tarsal joints not white..... 5.
- Bases of tarsal joints white:..... *stimulans* Walk.
5. Petiole of submarginal cell less than one-third of the length of that cell.
- *pungens* Wied.
- Petiole of submarginal cell at least one-half of the length of that cell.
- *impiger* Walk.

Females.

1. Front tarsal claws bearing a distinct tooth near middle of underside of each... 2.
- Front tarsal claws destitute of teeth..... 7.
2. Proboscis destitute of a white ring near the middle..... 3.
- Proboscis marked with such a ring, bases of tarsal joints white.
- *teniorhynchus* Wied.
3. Bases of tarsal joints distinctly white..... 4.
- Bases of tarsal joints never white..... 5.
4. Mesonotum marked with four stripes of silvery scales..... *fasciatus* Fabr.
- Mesonotum destitute of such stripes..... *stimulans* Walk.
5. Last two joints of hind tarsi never white..... 6.
- Last two joints of hind tarsi snow white..... *posticatus* Wied.
6. Abdomen marked with a cross band of whitish scales at base of each segment.
- *impiger* Walk.
- Abdomen never marked in this manner, but with a cluster of whitish scales at front angles of some of the segments..... *triseriata* Say.
7. Proboscis marked with a distinct whitish ring near the middle, tarsi white at sutures of the joints 8.
- Proboscis destitute of a whitish ring near the middle..... 9.

8. Tarsal joints white at bases only *perturbans* Walk.
Tarsal joints white at both ends *tarsalis* Coq.
9. Tarsi white at bases of joints 10.
Tarsi never white at bases of the joints 12.
10. Mesonotum never marked with stripes of silvery scales 11.
Mesonotum marked with four stripes of silvery scales, first tarsal joint never
marked with a whitish ring near the middle *signifer* Coq.
11. First tarsal joint marked with a whitish ring near middle of each. *excrucians* Walk.
First tarsal joint destitute of such a ring *excitans* Walk.
12. Petiole of submarginal cell less than one-third of the length of that cell.
pungens Wied.
Petiole of submarginal cell at least almost one-half of the length of that cell.
consobrinus Desv.

(b) UNRECOGNIZED SPECIES.

annulatus Schrank. This European species was credited to our fauna by Osten Sacken. The description agrees fairly well with specimens which I have identified as *excitans*, Walker, except that in the latter there is no white ring on the femora toward their apices.

boscii Desv. Probably a rubbed specimen of *pungens*.

nigripes Zett. Black, the legs of the male dark yellow, hairs of pleura of female gray, a band of white scales at base of each segment of her abdomen.

rubidus Desv. The description was apparently founded on a rubbed specimen of *Psorophora ciliata*.

testaceus v. d. Wulp. Is probably a somewhat injured example of *consobrinus*.

incidens Thomson. Is evidently a synonym of *impiger* Walker.

bigoti Bellardi. According to the figure and description, the bands of black scales are at the *bases* of the abdominal segments; in the recognized species these bands are always at the *apices* of the segments. In other respects this species must greatly resemble *pungens*.

cubensis Bigot. Apparently founded on a badly rubbed specimen of *pungens*.

frater Desv. This name was proposed for the *Culex fasciatus* of Wiedemann under the impression that this is not the same species as the one described by Fabricius under the same name. It seems quite certain, however, that the word "proboscis" in Fabricius' description was simply a lapsus for "palpi," and with this emendation the two descriptions agree very well.

mexicana Bellardi. Is evidently a synonym of *posticatus*.

provocans Walker. Is probably a synonym of *stimulans*. In some specimens of this species the light color at the bases of the tarsal joints is very indistinct.

territans Walker. Is apparently a synonym of *pungens*.

Our recognized species of *Culex* and their synonyms may be listed as follows, the synonyms indented:

consobrinus Desv.

? *annulimanus* v. d. Wulp (Anopheles).

impatiens Walker.

inornatus Williston.

pinguis Walker.

punctor Kirby.

? *testaceus* v. d. Wulp.

excitans Walker.

? *annulatus* Osten Sacken (*nec* Meigen, etc.).

excrucians Walker.
fasciatus Fabr.
 frater Desv.
 mosquito Desv.
 taeniatus Wied.
impiger Walker.
 implacabilis Walker.
 incidens Thomson.
 ? *quinquefasciatus* Say.
perturbans Walker.
posticatus Wied.
 ? *mexicanus* Bellardi.
 musicus Say.
pungens Wied.
 ? *boscii* Desv.
 ? *cubensis* Bigot.
 ? *territans* Walker.
signifer Coquillett.
stimulans Walker.
 ? *provocans* Walker.
taeniorhynchus Wied.
 damnosus Say.
 sollicitans Walker.
tarsalis Coquillett.
triseriatus Say.

IV.—GENUS PSOROPHORA.

Our single species is of a yellowish color, usually varied with brown, the bases of the tarsal joints white. It is considerably larger than any of our other species of yellowish or brown mosquitoes:

ciliatus Fabr.
 conterrens Walker.
 molestus Wied.
 ? *rubidus* Desv.

V.—GENUS MEGARHINUS.

Our three species are among the largest in this family, and are not known to occur north of the District of Columbia. They may be separated as follows:

All tarsi marked with white.....	<i>rutila</i> Coq.
Hind tarsi alone marked with white	<i>portoricensis</i> Roeder.
None of the tarsi marked with white	<i>hamorrhoidalis</i> Fabr.

VI.—GENUS AEDES.

Our two species are among the smallest of our mosquitoes, and have a pale brownish ground color. They may be distinguished as follows:

Thorax marked with a median violet blue stripe.....	<i>sapphirinus</i> O.S.
Thorax destitute of such a stripe.....	<i>fuscus</i> O.S.

